MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2015/2016

HBC1021 – BIOCHEMISTRY II

1st MARCH 2016
2:30 – 4:30 PM
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This paper consists of **8** pages (including the front page) with **2** Parts (**A** and **B**).

2. **Part A** consists of **20** Multiple Choice Questions (MCQ). All questions carry equal marks (1 mark per question). Answer **ALL** questions in the **OMR** provided on page **6** of this paper.

3. **Part B** consists of **6** Short Answer Type questions. All questions carry equal marks (10 marks per question). Answer **FIVE (5) QUESTIONS ONLY.** Print your answers **clearly** and **neatly** in the Answer Booklet provided.

SECTION A: MULTIPLE CHOICE QUESTIONS (MCQ)

Questions 1 to 20 [20 marks]

1. Which one of the following statements about glycolysis is **TRUE**?
   A. The conversion of glucose to lactate requires the presence of oxygen.
   B. Other sugars, such as sucrose, maltose can enter glycolysis.
   C. Fructose 2,6-bisphosphate is a potent inhibitor of phosphofructokinase.
   D. The regulated reactions are also the irreversible reactions.

2. In eukaryotes, glycolysis takes place in _____ while gluconeogenesis takes place in _____.
   A. cytosol, mitochondria
   B. cytosol, cytosol
   C. cytosol, mitochondria and cytosol
   D. nucleus, mitochondrial inner membrane

3. Which one of the following statements about gluconeogenesis is **TRUE**?
   A. It occurs in muscle.
   B. It is stimulated by fructose 2,6-bisphosphate.
   C. It is inhibited by elevated levels of acetyl CoA.
   D. It is important to maintain blood glucose during the normal overnight fast.

4. Which one of the following statements about the principle fuel metabolism by organs is **FALSE**?
   A. Brain is both source and consumer of fuel.
   B. Liver and adipose tissue function as fuel storage tissues and reservoirs.
   C. Muscle is both source and consumer of fuel, leaning heavily toward consumption.
   D. Kidney is only a significant source under starvation.

5. Epinephrine signaling pathway inhibits _____ while glucagon signaling pathway activates _____.
   A. glycolysis, glycolysis
   B. glycogenolysis, glycolysis
   C. glycolysis, gluconeogenesis
   D. glycolysis, glycogenesis

6. Light absorbed by a chlorophyll *a* causes
   A. an electron to move from the photon to the chlorophyll.
   B. an electron to move from ground state to an excited state.
   C. an electron to move to a neighboring water molecule.
   D. an electron to move from chlorophyll to ADP.

Continued...

7. In the Calvin cycle, 3-phophoglycerate is converted into which hexose phosphate?
   A. Glucose 1-phosphate
   B. Glucose 6-phosphate
   C. Fructose 6-phosphate
   D. All of the above

8. Which one the following statements about the urea cycle is **FALSE?**
   A. The cycle is linked to gluconeogenesis.
   B. Malfunction of the cycle may lead to brain damage.
   C. The nitrogenous waste produced during the amino acid breakdown is converted into carbamoyl phosphate before it enters the urea cycle.
   D. The cycle requires no ATP for its activities

9. How many rounds of β oxidation would be required for a 16-C fatty acyl chain to be degraded to acetyl-CoA:
   A. 16
   B. 7
   C. 15
   D. none of the above

10. Triacylglycerol molecules stored in adipose tissue represent the major reserve of substrate providing energy during a prolonged fast. During such a fast,
   A. the stored fatty acids are released from adipose tissue into the plasma as components of the serum lipoprotein particle, VLDL.
   B. free fatty acids are produced at a high rate in the plasma by the action of lipoprotein lipase on chylomicrons.
   C. glycerol produced by the degradation of triacylglycerol is an important direct source of energy for adipocytes and fibroblasts.
   D. hormone-sensitive lipase is phosphorylated and activated by a cAMP-activated protein kinase.

11. Uricotelic organisms release nitrogen as
   A. NH_4^+
   B. arginine
   C. uric acid
   D. all of the above

12. Which of the following statements about pentose phosphate pathway is **FALSE**?
   A. It generates NADH for reductive biosynthesis.
   B. It is linked to glycolysis pathway by transaldose and transketolase.
   C. It consists of oxidative and non-oxidative stages.
   D. It produces five-carbon sugar for nucleotide biosynthesis.

Continued...

13. In the United States, newborns are commonly screened for diseases of amino acid metabolism as below **EXCEPT**:
    A. Phenylketonuria
    B. Apple syrup urine disease
    C. Homocystinuria
    D. Tyrosinemia

14. Which of the following is the fuel used by the brain during starvation?
    A. Glycogen
    B. Ketone bodies
    C. Amino acids
    D. Branched chain amino acids

15. Which of the following molecules **IS NOT** a secondary metabolite?
    A. Resveratrol
    B. Rifamycin
    C. Artemisinin
    D. Coenzyme Q10

16. Which of the following statement(s) about the principle of metabolism is/are **FALSE**?
    i. The formation of adenosine triphosphate (ATP) decouples energy-releasing pathways from energy-requiring pathways.
    ii. The oxidation of carbon fuels powers the formation of ATP.
    iii. Many types of biological reactions and intermediates are unique for the specific metabolic pathways.
    iv. Metabolic pathways are highly regulated.

    A. i and ii
    B. i and iii
    C. iii
    D. i and iv

17. Metabolic pathways can be regulated by _____.
    i. the quantities of the enzymes
    ii. the subcellular localization of the enzymes
    iii. the post-translational modification of the enzymes
    iv. the allosteric regulation of the enzymes

    A. i and iv
    B. ii and iii
    C. i, ii and iv
    D. i, ii, iii and iv

Continued...

18. Which of the following biomolecules can be used as substrates for gluconeogenesis?
    i. Glycerol
    ii. Succinate
    iii. Lactate
    iv. Amino acid

    A. i and ii
    B. ii and iii
    C. i, ii and iv
    D. i, iii and iv

19. Which of the following statements about metabolic fates of pyruvate after glycolysis are **TRUE**?
    i. In the presence of oxygen, pyruvate can be oxidized to acetyl-CoA, which enters the citric acid cycle for further oxidation
    ii. Pyruvate can be converted to oxaloacetate, which can be a precursor in gluconeogenesis.
    iii. In the absence of oxygen, pyruvate can be converted to ethanol by microorganism.
    iv. In the absence of oxygen, pyruvate can be converted to lactate in the exercising muscles and red blood cells.

    A. i and ii
    B. ii, iii, iv
    C. i, ii and iii
    D. i, ii, iii and iv

20. The source(s) of NH_2 groups in synthesis of nucleotides is/are:
    i. aspartate
    ii. glutamine
    iii. glycine
    iv. lysine

    A. i and ii
    B. i and iii
    C. ii and iv
    D. i, ii and iii

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MULTIPLE CHOICE QUESTION ANSWER SHEET

TABLE NO:_____ STUDENT ID:_____

SUBJECT: _____ SUBJECT CODE:_____

1. (A)(B)(C)(D)	2. (A)(B)(C)(D)	3. (A)(B)(C)(D)	4. (A)(B)(C)(D)
5. (A)(B)(C)(D)	6. (A)(B)(C)(D)	7. (A)(B)(C)(D)	8. (A)(B)(C)(D)
9. (A)(B)(C)(D)	10. (A)(B)(C)(D)	11. (A)(B)(C)(D)	12. (A)(B)(C)(D)
13. (A)(B)(C)(D)	14. (A)(B)(C)(D)	15. (A)(B)(C)(D)	16. (A)(B)(C)(D)
17. (A)(B)(C)(D)	18. (A)(B)(C)(D)	19. (A)(B)(C)(D)	20. (A)(B)(C)(D)

SECTION B: SHORT ANSWER TYPE QUESTIONS (SAT)

Question 1

A. What are the two phases of glycolysis? Describe the energy input and output of these two phases. [2 marks]

B. Why is citric acid cycle described as amphibolic? [2 marks]

C. How is ATP generated from substrate-level phosphorylation and oxidative phosphorylation? [2 marks]

D. NADPH is an inhibitor of the pentose phosphate pathway. What is the metabolic logic behind this regulatory process? [2 marks]

E. What happens when the reduction of oxygen is incomplete in cellular respiration? [2 marks]

Continued...

Question 2

A. How is the urea cycle linked to the citric acid cycle? [3 marks]

B. What are the sources of carbon and nitrogen molecules for amino acid biosynthesis? [2 marks]

C. What are the major entry points of ammonia into metabolism in animal? [1 mark]

D. What is the difference between cyclic and noncyclic electron flow? [2 marks]

E. What would be the effect on plants if photorespiration did not exist? [2 marks]

Question 3

A. Why do purine salvage pathways save the cell energy? [2 marks]

B. How is ATCase, a key enzyme in pyrimidine biosynthesis, inhibited? [2 marks]

C. Name one each for deleterious consequences of defective purine metabolism and defective pyrimidine metabolism. [2 marks]

D. Reduction of the ribose moiety to deoxyribose occurs at the diphosphate level and is catalyzed by what enzyme? [2 marks]

E. What are the products of pyrimidines catabolism? [2 marks]

Question 4

A. Name two physiological roles of fatty acids. [2 marks]

B. List four products from the reactions of beta oxidation. [2 marks]

C. Explain the metabolic reasons behind the following statement: "Carbohydrate molecules provide only about one-half the caloric energy of a fatty acid molecules of similar molecular weight." [2 marks]

D. List two differences between mitochondrial and peroximal beta oxidation. [4 marks]

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Question 5

A. Skeletal muscle has several distinct fiber types. Type I is used primarily for aerobic activity, whereas Type II is specialized for short, intense bursts of activity. How could you distinguish between these types of muscle fiber if you viewed them with an electron microscope? [2 marks]

B. Diabetes is the most common metabolic disease in the world. Define the Type 1 and Type 2 diabetes. [2 marks]

C. Ingesting large amounts of glucose before a marathon might seem to be a good way of increasing the fuel stores. However, experienced runners do not ingest glucose before a race. What is the biochemical reason for their avoidance of this potential fuel? [2 marks]

D. Give two metabolic engineering strategies that can be used to improve the production of natural products. [2 marks]

E. What is heterologous expression? [2 marks]

Question 6

A. What are the two major roles of Cori cycle in muscle? [2 marks]

B. What effect does citrate have on gluconeogenesis and glycolysis? [2 marks]

C. Given that acetyl CoA cannot be a substrate for gluconeogenesis, why is its production in fatty acid oxidation essential for gluconeogenesis? [2 marks]

D. Name two types of metabolic reactions. [2 marks]

E. What is the difference between anabolic and catabolic reactions? [2 marks]

End of paper